without exception. In older specimens one or more cells are lost, and the frond becomes therefore apparently irregular (*l. c.* 26).

1. *Pandorina* (Pritchard, Diat. pp. 157, 517, t. 19. f. 59–69) and *Eudorina* are the same.
2. *Gonium.* (Pritchard, Diat. pp. 152, 517, t. 19. f. 32–37.)
3. *Volvox.* (Pritchard, Diat. pp. 180, 526, t. 20. f. 32–47.)
4. *Stephanosphæria.* (Pritchard, Diat. p. 529, t. 19. f. 38–58.)

According to Dr. Hicks, the *Volvox* is perpetuated in two ways: 1, by the encysted cell or oospore; 2, by the motionless segment of the zoospore, which clearly has its homologue in many Algæ, and is free from motion because without cilia, and thereby distinguished from *zoospores.* (Quart. Journ. Microscop. Science, 1861, p. 283, t. 9. f. 1–11.)

PROCEEDINGS OF LEARNED SOCIETIES.

ROYAL SOCIETY.

June 20, 1861.—Major-General Sabine, Treasurer and Vice-President, in the Chair.

"On the Anatomy and Physiology of the Spongiadæ" (Part II.), by J. S. Bowerbank, LL.D., F.R.S., F.L.S., &c.

This paper is a continuation of the first division of the subject, published in the Phil. Trans. for 1858.

In the second part of this division the author treats of the keratode or horny substance of the skeleton, as regards both its physical and chemical characters, with a view of establishing the animal nature of that substance.

In the third part the membranous tissues are described under two heads:—

1st. Simple membranous tissues analogous to those of the basement membranes of the higher classes of animals; and

2nd. Compound membranous tissues. These structures consist of simple membranous tissue combined with primitive fibrous tissue. Their most simple forms exist in the membranes lining the interstitial cavities of the sponge and in the dermal membrane.

In the fourth part the fibrous tissues are described as consisting of three principal divisions.

1st. Primitive fibrous tissue. These structures are exceedingly minute, and form an important element in the construction of the compound membranous tissues of the animal.

2nd division. The fibres of the skeleton are described under the following heads:—

1st. Solid simple keratose fibre.

2nd. Spiculated keratose fibre, in which the keratode is the primary element.

3rd. Multispiculate keratose fibre,—the spicula being the primary element, and the keratode the secondary or cementing medium.

4th. Inequi-spiculated keratose fibre. Consisting of skeleton fibres constructed of numerous spicula irregularly dispersed, but congregated into a round or oval massive fibre.

5th. Simple fistulose fibre. A keratose fibre having a continuous simple central canal.

6th. Compound fistulose fibre. A keratose fibre with a continuous central canal, from which secondary small canals branch at about right angles to the primary one.

7th. Regular arenated keratose fibre. Constructed of solid cylindrical fibres, in the centre of which there is a series of grains of sand or other extraneous matters.

8th. Irregular arenated keratose fibre. Consisting of grains of sand or other extraneous matters cemented together into a continuous cylindrical fibre.

In the third division the siliceous fibrous tissues are described as solid cylindrical structures, similar in form to the solid keratose fibres of the second division, but consisting of pure silex in place of keratode.

The fifth part contains descriptions of the cellular structures.

The sixth and last part of this division treats of the physical characters of the sarcode or semi-gelatinoid substance lining the interior cavities of sponges.

Part II.—*Organization and Physiology.*

The author treats this portion of his subject under the following heads:—

1st. The skeleton. Its general structure and component parts. Under this head the physiological purposes of the various forms of spicula, treated of in the first part of the paper, are described, and their peculiar offices in the sponge pointed out.

2nd. The sarcodous system is considered by the author as the homologue of the mucous lining of the stomach and intestines of the higher tribes of animals, and probably as the equivalent of the nervous system also.

3rd. The interstitial canals are considered as the equivalents of the stomach and alimentary canals of the higher animals.

4th. The intermarginal cavities, situated immediately beneath the surface, and receiving the incurrent streams from the pores, are believed by the author to be the organs for the secretion of the vital fluids of the animal.

5th. The dermal membrane, enveloping the whole of the sponge, and in which the inhalant and exhalant orifices of the animal are situated.

6th. The pores or inhalant orifices. These organs are not permanent; *i. e.* they are opened and closed at the will of the animal, and when once closed seldom occur again in precisely the same spot.

7th. The oscula or excurrent orifices, usually permanent organs, and capable of being opened or closed in accordance with the necessities of the animal.

8th. Inhalation and exhalation. Two modes of these operations are described; one as occasional or intermittent, but very powerful, for the imbibition of nutriment; the other gentle and continuous, for the purposes of the aëration of the vital fluids, and for the ejection of digested matters.

9th. Nutrition. The modes of imbibition and periods of digestion are treated of; and the author describes a series of contrivances by which some sponges are in possession of peculiar organs which enable them to prey upon annelids or other soft creatures that may crawl over their surface or intrude within their cavities or canals.

10th. Cilia and ciliary action. The accounts of the cilia of the gemmules or ova, as described by Dr. Grant and other writers, are referred to by the author; and the same organs *in situ* in *Grantia compressa* are pointed out as the powers on which inhalation and exhalation are dependent.

11th. Reproduction, gemmules, &c. Under this head the ovaries, ova, and gemmular modes of propagation are described under five heads:—

1st. Ova without an ovarium.
2nd. Ova generated within ovaria.
3rd. Gemmules secreted within the sponge.
4th. Gemmules produced externally.
5th. By spontaneous division of the sarcode.

The remaining portions of the paper, consisting of observations on the generic characters, the specific characters, and on the mode of examination, will form the subject of a future communication.

"Observations on the Posterior Lobes of the Cerebrum of the Quadrumana, with a Description of the Brain of a *Galago*," by William H. Flower, Esq., Demonstrator of Anatomy at the Middlesex Hospital.

After referring to the present state of our knowledge upon the subject, and especially to the descriptions recently given of the "posterior cornu of the lateral ventricle" and "hippocampus minor" in the Orang-Utang by Dr. Rolleston, in the Chimpanzee by Mr. Marshall, and in *Ateles* by Mr. Huxley, and the statement of M. Gratiolet, that the posterior cornu of the lateral ventricle or "*cavité ancyroïde*" obtains an enormous development in Monkeys, the author proceeds to detail his own observations (which are illustrated by drawings and photographic representations) upon the condition of these parts in the brains of animals belonging to the three families of the order *Quadrumana*.

Family 1. CATARRHINA.

Orang-Utang (*Pithecus satyrus*).—An account is given of the examination of the brain of a young female of this species, preserved in the Middlesex Hospital Museum. The posterior lobes of the cerebral hemispheres were so far developed that they completely covered the cerebellum, although not prolonged backwards to quite so great an extent as in the human brain. To examine the interior, the right hemisphere was removed to the level of the inferior surface of the corpus callosum, and then further portions were carefully dissected away, so as to expose the lateral ventricle, with its three cornua and their contained structures. It is to be observed that brains which have been long in spirit are in some respects not so well adapted for dissection as when in a recent condition, as the distinction in appearance between the white and grey substance is lost, and the contiguous walls of cavities, which in the natural state would have fallen apart, have now become hardened in such close contact that their real nature may readily be overlooked. In this way only can the statements of Tiedemann as to the absence or rudimentary condition of the posterior cornu in the Simiæ be accounted for. However, the brain of this Orang is sufficiently well preserved to show that its ventricular cavity presents almost the exact counterpart of that in the human subject. The posterior cornu extends quite as far backwards as in an average example in man, its apex being but $\frac{3}{8}$ of an inch ($=\frac{1}{8}$ of the entire length of the hemisphere) from the occipital extremity of the hemisphere; and its direction well answers to the description "backwards, outwards, and then inwards." Upon the inner wall of the cavity is the hippocampus minor, which will bear comparison with a very well-developed specimen of this structure as met with in the human brain, where, as is well known, it is subject to great variations in size and form. Its length is $\frac{5}{8}$ inch, its breadth at the base $\frac{3}{16}$ inch. The portion of the wall of the ventricle situated opposite the junction of the descending and posterior cornua (called eminentia collateralis or pes accessorius) corresponds in configuration and relative size to the similar part in the brain of man. The hippocampus major has no distinct digital marks; these are, however, indicated by a nodulated appearance in the expanded termination. The remaining portion of the ventricle presented nothing requiring special remark. In order to verify these observations by an examination of the corresponding parts of the opposite side, the upper part of the left hemisphere was also removed, and a very good view obtained of the ventricle, with its posterior cornu. It was precisely similar to that just described, the two sides exhibiting in their internal structure a perfectly symmetrical appearance.

Cercopithecus.—Four examples of this genus which have lately died at the Gardens of the Zoological Society were examined while in a recent condition. The first was *C. pygerythrus* (the Vervet Monkey). In order that the brain might be examined *in situ*, the right side of the cranium was removed in the following way. First, a longitudinal incision was made with the saw, a quarter of an inch to the right of the middle line, from the supraorbital ridge to the foramen magnum; then with the bone forceps the whole of the cranial wall thus marked out was carefully cut away down to the base, as were also the right halves of the three upper cervical vertebræ. The dura mater being then removed, a photograph was taken, in which the relative position of the different parts of the brain are well seen. The posterior lobes of the cerebrum project to the extent of $\frac{1}{4}$ inch beyond the cerebellum, covering it more completely than in the Orang, and nearly, if not quite, as much so as in man. The upper part of the remaining portion of the calvarium was now removed, a section made across the hemispheres at the level of the lower surface of the corpus callosum, and the lateral ventricles opened out on both sides. Although in general form and in the arrangement of the structures composing their walls these cavities present a great resemblance to those of the human brain, one remarkable peculiarity immediately strikes the observer, viz. the great development of the posterior cornu, with the contained hippocampus minor. It extends from the commencement of the descending cornu to near the apex of the well-developed posterior lobe, is of considerable vertical depth, being curled round the voluminous projection of the hippocampus minor, and is directed at first somewhat outwards and backwards, then directly backwards, and finally takes a considerable sweep towards the middle line—the characteristic form which has obtained for this part in man the name of "digital cavity." The hippocampus minor is formed, as in the human brain, by the deep involution of a layer of superficial grey cerebral matter, covered internally by a layer of white substance, which is so thin that the surface of this prominence had a darker look than the other parts of the ventricular walls. It differs from a typical example of the corresponding part in the human subject in its great relative size, both as to length and as to the extent to which it projects into the ventricle. The hippocampal sulcus (well marked on the inner surface of the posterior lobe of all apes) is not only very deep, but has concealed within it a convolution of considerable size, in the form of a longitudinal eminence attached to the floor of the fissure. The eminentia collateralis is prominent. The hippocampus major is smooth upon the surface. The anterior cornu is of the same form and extent as in the human brain.

In the brains of *C. sabæus*, *C. mona*, and *C. ruber* a similar disposition of these parts was found. In the last-named, the posterior lobe of the cerebrum is even more prominent, and the hippocampus minor of still greater size, as it tapers less towards its termination; in fact this eminence is here actually larger than the hippocampus major, to which its true relation can be better studied in these apes than in man.

Macacus.—In a monkey of this genus (*M. erythræus*) the posterior cornu and hippocampus minor were observed to obtain almost as large a development.

Family 2. PLATYRRHINA.

In *Cebus apella* the ventricular cavity resembles in all essential particulars that of *Cercopithecus*. There is the same extent of posterior cornu and the same complex arrangement of anfractuosities, producing the very protuberant hippocampus minor.

It is among the members of this family (e. g. *Saimiris*) that the projection backwards of the posterior lobes of the cerebrum attains its greatest extent.

Family 3. Strepsirhina.

The cerebral anatomy of the Lemurs is still imperfectly known; therefore a detailed description is given in the paper of the brain of a species of *Galago*, the most important part of which is the following note upon its internal structure:—"A horizontal section of both hemispheres was made at the level of the corpus callosum, and the lateral ventricles laid open. A broad and very distinct posterior cornu extends backwards almost to the extremity of the hemisphere, occupying nearly the whole of the posterior lobe. Its floor and inner wall are raised into a prominence, having distinctly the characters of the hippocampus minor as found in man and the higher Quadrumana, and corresponding with the bottom of the sulcus before noted on the under surface of the lobe. The form of this eminence is somewhat triangular, the apex being directed backwards; but the surface is convex, both from above downwards, and in the antero-posterior direction, so that the axis of the cavity that contains it, though directed generally backwards, has first an outward inclination, and finally turns somewhat inwards. The anterior or broad end of the eminence is concave, being adapted to the curved posterior margin of the hippocampus major, from which it is separated by a deep groove. The length of the hippocampus minor is $\frac{1}{4}$ of an inch, its breadth at the base almost as much. The outer wall of the ventricle has a distinct projection into the angle between the hippocampi, nearly corresponding with the 'eminentia collateralis' of the human brain. On comparing the posterior lobe and hippocampus minor in *Galago* with the same parts in the true apes (e. g. *Cercopithecus*), it is seen that though the anterior part is proportionally as broad, the length is considerably diminished, the portion that is wanting being equivalent to that part which, in the apes, covers the posterior third of the cerebellum and projects beyond it."

As none of the authors who have written upon the brains of the Lemuridæ describe a hippocampus minor, as Vrolik expressly states that it is absent in *Stenops*, and as Burmeister alone assigns a posterior cornu to the ventricle (in *Tarsius*), it seemed desirable, after the results of the observation of these parts in *Galago*, to re-examine the brain of some other members of the family. Two specimens in spirit of *Loris* (*Stenops*) *Bengalensis*, placed at the author's disposal for this purpose by Dr. Grant, afforded distinct evidence of the existence of a well-developed posterior cornu and hippocampus minor, though unfortunately in neither instance were the brains in sufficiently good preservation to allow of a satisfactory description or figure of the parts being made.

Galago and *Stenops* being generally considered as not very elevated forms in the Lemurine family, we can have but little doubt as to the presence of the posterior cornu and hippocampus minor throughout the different members of the group; and hence a most important character is supplied for determining the affinities of these interesting animals. It indicates as decisively their position among the Quadrumana, as it separates them completely from the Insectivora, in which order some naturalists have placed them.

Many links are still wanting in the chain of evidence required to determine the true history and classificatory value of the posterior horn of the lateral ventricle, and the peculiar disposition of cerebral substance constituting the hippocampus minor; but the conditions in which they have been found at so many distinct points of the series, appear to lead almost irresistibly to the following conclusions:—

1. That these parts, so far from being (as has been stated by some anatomists) peculiar to the human brain, are common to man and the whole of the Quadrumana, including even the lowest forms.

2. That they attain their maximum of development in species which do not belong to either extremity of the series.

3. That in the lower forms their diminution takes place chiefly in the antero-posterior direction, corresponding with the reduced length of the posterior cerebral lobes, the greater part of which is occupied by them.

4. That in the higher forms they are narrower in proportion to their length, and bear a smaller ratio to the surrounding mass of cerebral substance.

5. That the extreme of the last condition is met with in man, where these parts are also characterized by their variability in size and form, want of symmetry on the two sides, and frequent rudimentary condition, or even entire absence.

Communication received August 20, 1862.

"On the Aquiferous and Oviducal System in the Lamellibranchiate Mollusks," by George Rolleston, M.D., F.L.S., Linacre Professor of Anatomy; and C. Robertson, Esq., Demonstrator of Anatomy, Oxford.

After recapitulating the views which have been held by various authors as to the means by which certain Lamellibranchiata are enabled to distend their muscular foot, the authors of this paper proceed to make a retractation of the opinions they put forward as to the oviducal system in these mollusks in a paper read before the Royal Society, February 3, 1859. But, though they have some reason to agree with M. La Caze Duthiers's views, as expressed in a paper read before the Royal Society, December 15, 1859, so far as the oviducal outlet is concerned, they are not prepared to coincide with that writer in denying altogether the existence in these animals of an aquiferous system distinct from their blood-vessels. Upon this point their views remain much the same as those they enunciated in their paper already referred to, and they may be briefly summed up thus.

They hold that, side by side with, and yet distinct from, the blood-vascular system in the Lamellibranchiata, there exists another system of tubes forming an aquiferous tree, the trunk of which serves as an outlet for the generative products, whilst many of its branches spread throughout the foot into regions not occupied by the organs of reproduction. This system is such a one as the perivisceral chamber has been shown to be by Mr. Hancock in the 'Philosophical Transactions' for the year 1858, spreading itself into ramifications, some of which are, whilst others are not, in connexion with the reproductive glands. The authors allow, and indeed show in the way of experiment, that it is possible for the water in which the animal lives, to become intermingled with the blood within its vessels by the route of the organ of Bojanus, and it will be seen from what has even already been said, that they suppose the aquiferous system to be fed with water by transudation of that fluid from the blood-vessels.

They begin by describing three sets of experiments in the way of injections, to show that water can find its way into the pericardial blood-lacunæ through the organ of Bojanus, and from thence into the vessels which carry the systemic blood towards, and only into those which carry it *towards*, the gills.

The results of two other sets of experiments are next adduced in proof of the non-existence in the blood-vascular system, first, of any lacuna save in this pericardial space; and secondly, of any communication with the exterior by pores, save such as the two sacs of the organ of Bojanus may be held to represent upon a gigantic scale.

What is new, however, in this part of the paper, is not so much the conclusions as the methods the authors have adopted for demonstrating them.

In proceeding to argue for the existence of a system of tubes distinct from the blood-vascular system, the authors begin by contrasting the appearance which the non-generative part of the foot presents when it is injected, as it is easily, from the orifice which serves as generative outlet, with that which it presents when injected from the blood-vessels.

Secondly, they show that it is possible, when the blood-vessels are already fully occupied by an injection of one colour, to cause a second, or when the artery and the vein have been filled with differently coloured fluids, a third system of vessels to make their appearance throughout the foot-mass by throwing a differently coloured injection into the oviducal outlet.

Thirdly, microscopic examination of animals thus treated excludes the idea that the fluid thus interposed between and amongst blood-vessels has found its way simply into interstitial spaces left between them and the tissues, as it shows that it is contained within a system of tubes as well defined and limited off from the surrounding tissues as is the fluid which has been thrown into the blood-vessels themselves.

That the water which has been shown to enter the body by the intermediation of the organ of Bojanus finds its exit by the same route, the authors believe to be rendered in the highest degree improbable by the fact that they have found it impossible to make fluid pass in the direction this hypothesis postulates; that is, from the blood-vessels, into the pericardium.

Similar improbability attaches to a view which supposes a fluid of such chemical and such morphological characters as the blood of the Lamellibranchiata to suffer dilution to such an extent as the observable distention of their foot would necessarily imply, and which argues from phenomena noticed on the sudden removal of the animal from the water as though they could be regarded as identical with normally occurring physiological processes.

As their injections seem to them to prove the existence of a system of vessels distinct from and yet in most close apposition to the blood-vessels and permeating the several tissues of the body in company with them, the facts of the case seem to the authors to necessitate the belief that a transference of fluid takes place, as in other organisms, from the latter to the former set of vessels.

The animals experimented upon were Unionidæ of the two species *Anodonta Cygnea* and *Unio margaritifera.*

MISCELLANEOUS.

On the Larval state of the Muscidæ. By Rud. Leuckart.

It is, I think, a very general opinion that, up to their change into pupæ, the headless larvæ of the flies are subject only to such changes as are brought about by their growth and the formation of their generative organs. Wherever any other differences were observed between the newly-hatched and full-grown larvæ, as in the *Œstridæ* (Joly) and the *Pupipara* (Leuckart), these have hitherto been regarded as exceptional cases.

This view is erroneous. Investigations which I made in the course of last summer upon the development of various *Muscidæ* render it probable that the animals belonging to this group in general, like the above-mentioned *Œstridæ* and *Pupipara*, present several different larval forms. The differences of these larval forms do not, indeed, extend so far as to lead one to mistake their genetic relations, but they are nevertheless sufficiently striking to fix the interest and attention of the naturalist.

The differences of these larval forms are most distinctly indicated in the formation of the buccal organs and of the stigmata. Reserving further particulars for a future communication, I will in the following only indicate in a few words the chief differences of the three larval states observed by me in *Musca vomitoria* and *M. cæsarea.*

First stage (duration in summer about twelve hours).—Anterior stigmata wanting. The truncated posterior end bears on each side two closely approximated, cleft-like air-holes. The oral opening, in repose, is a triangular pit, the lateral edges of which converge in front and bear a chitinous ridge, at the anterior extremity of which a number of small teeth follow. When the mouth is opened, the lateral horny ridges separate at their anterior extremity. The pos-